MULTICHIP MODULE HIGH SPEED TESTING

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Progress in the testing of multichip module electronic circuit packages for the period Jan. 1, 1993 - Mar. 31, 1993 is described below, in the areas of the testing of multichip modules using electrooptic polymers and organic crystals.

Electrooptic Polymers

We have continued our investigations into the use of the copolymer system PMMA:MA1 for use as an electrooptic material for the testing of multichip module packages. We have recently obtained real-time electrooptic signals from such an arrangement, using a commercially available 780 nm laser diode source and a coplanar Al electrode (see Fig. 1). The polymer was spun-on and cured, giving a thickness of approximately 3-4 μm. The material was then poled at 132° C, the glass transition temperature, with 2500 V across the 25 μm electrode gap, corresponding to a field of 0.50 MV/cm. The gap was illuminated by approximately 4 mW of optical power, limited by reflection losses in the focusing lens and loss in the polarizer. The electrode was biased with 5 V pulses at 1.0 kHz; the frequency response is currently limited by the time response of the differential photodetector and the current-to-voltage amplifier. We observed signals of approximately 7 mV on top of 2 mV peak-to-peak noise, corresponding to a signal-to-noise ratio (SNR) of approximately 13 dB (Fig. 2). Since the laser is run CW and the time response of the polymer is nearly instantaneous, the time response of the experiment is limited only by that of the photodiodes and electronics, giving a rather flexible testing method.

Future work in the application of PMMA:MA1 to multichip module testing will be directed towards increasing both the signal-to-noise ratio and the frequency response by reverse biasing the p-i-n photodiodes and by improving the post-diode electronics. We then plan to apply this testing method to multichip module transmission lines from both IBM and from the GE HDI program.

DBNMNA Electrooptic Organic Crystals

We have also used crystals of 2,6-dibromo-n-methyl-4-nitroaniline (DBNMNA) to sense voltages in a coplanar electrode. DBNMNA is an attractive electrooptic material because of its low absorption (< 15 cm^{-1}) and relatively high electrooptic response (> 30 pm/V) at visible wavelengths, which may ease alignment problems in a electronic test setup and also allow the use of inexpensive sources such as HeNe lasers. We have also observed real-time electrooptic signals in the same experiment as Fig. 1 using DBNMNA as the electrooptically active material, and using a 10 mW HeNe laser (632.8 nm) visible red laser. The signal-to-noise ratio was slightly improved over the PMMA:MA1 experiment because of the higher electrooptic coefficient of the organic crystal (30 pm/V versus approximately 4 pm/V).

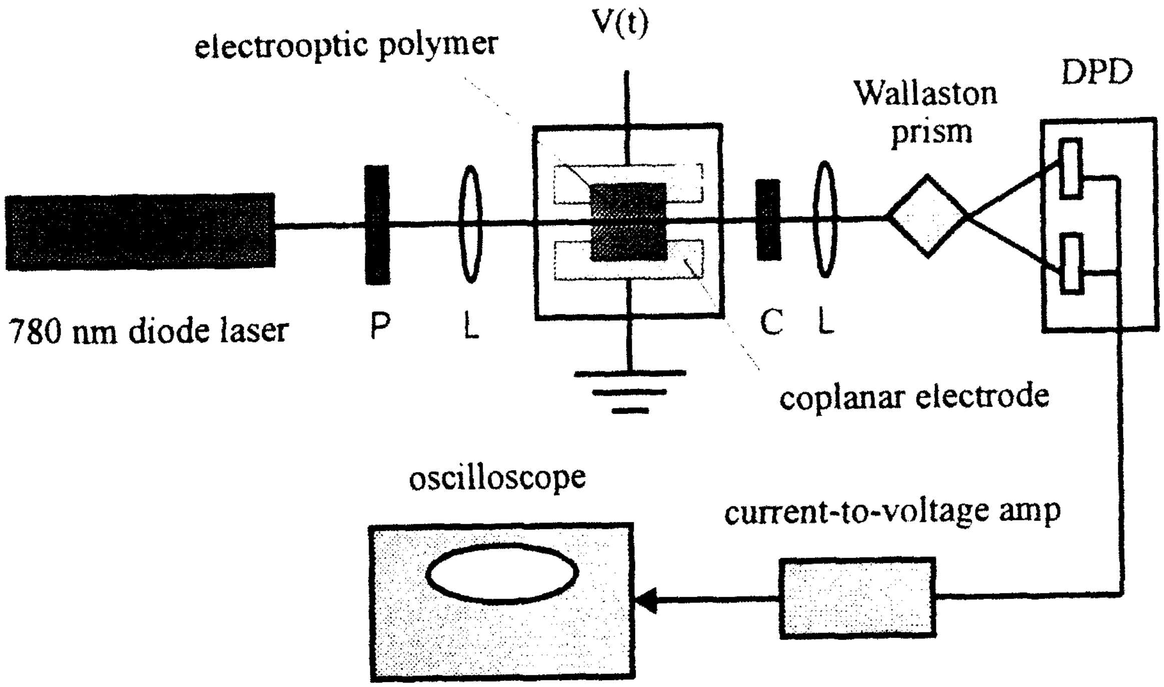

Fig. 1 The experimental arrangement for the electrooptic testing using electrooptically active polymers. P - polarizer; L - lens; C - comparator. The differential photodetector, DPD, senses the amplitudes of the two polarizations separated by the Wallaston prism.

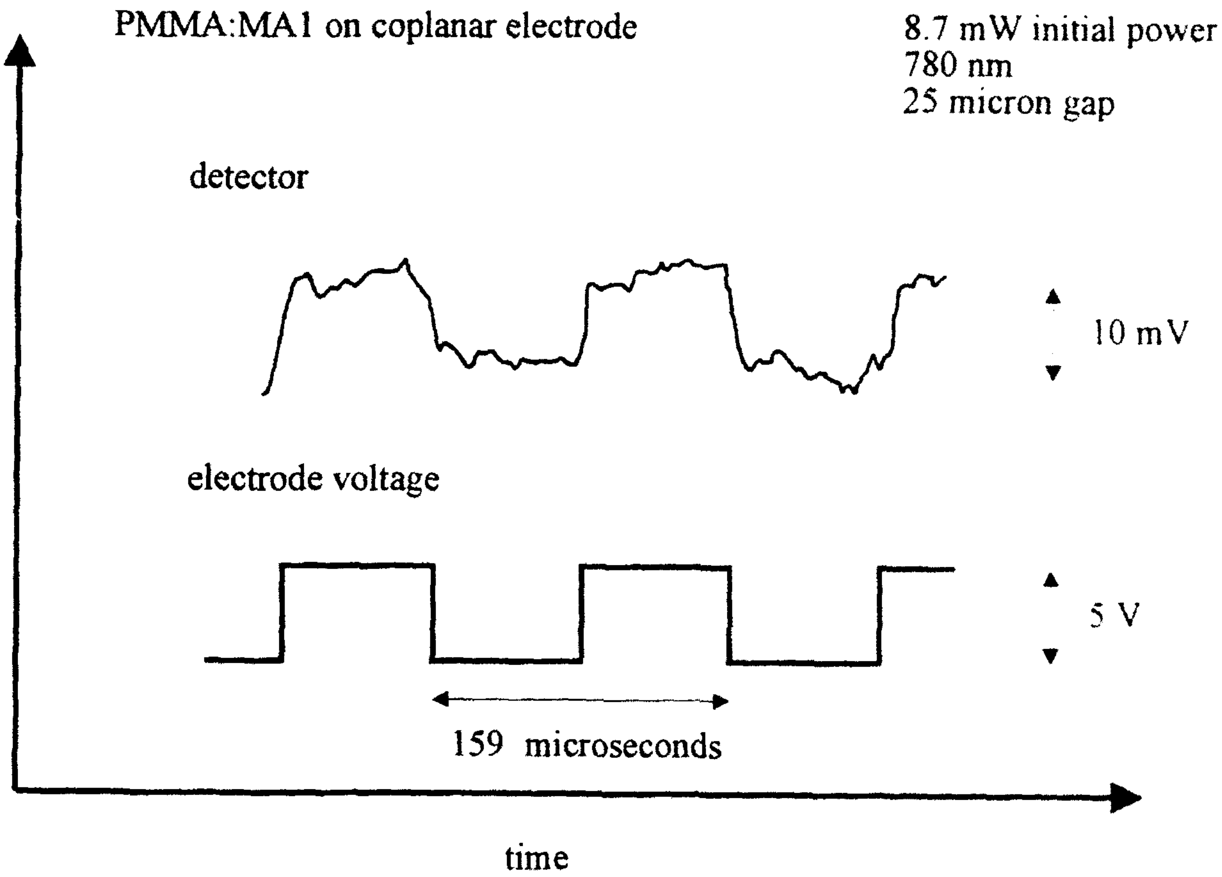

Fig. 2 Real-time electrooptic signals observed from PMMA:MA1 on a coplanar electrode with a 25 μm gap. Incident 780 nm power on the actual gap was reduced from 8.7 to 4 mW by reflection and polarization losses. The repetition rate of 1 kHz was limited by the time response of the photodiodes and amplification system.